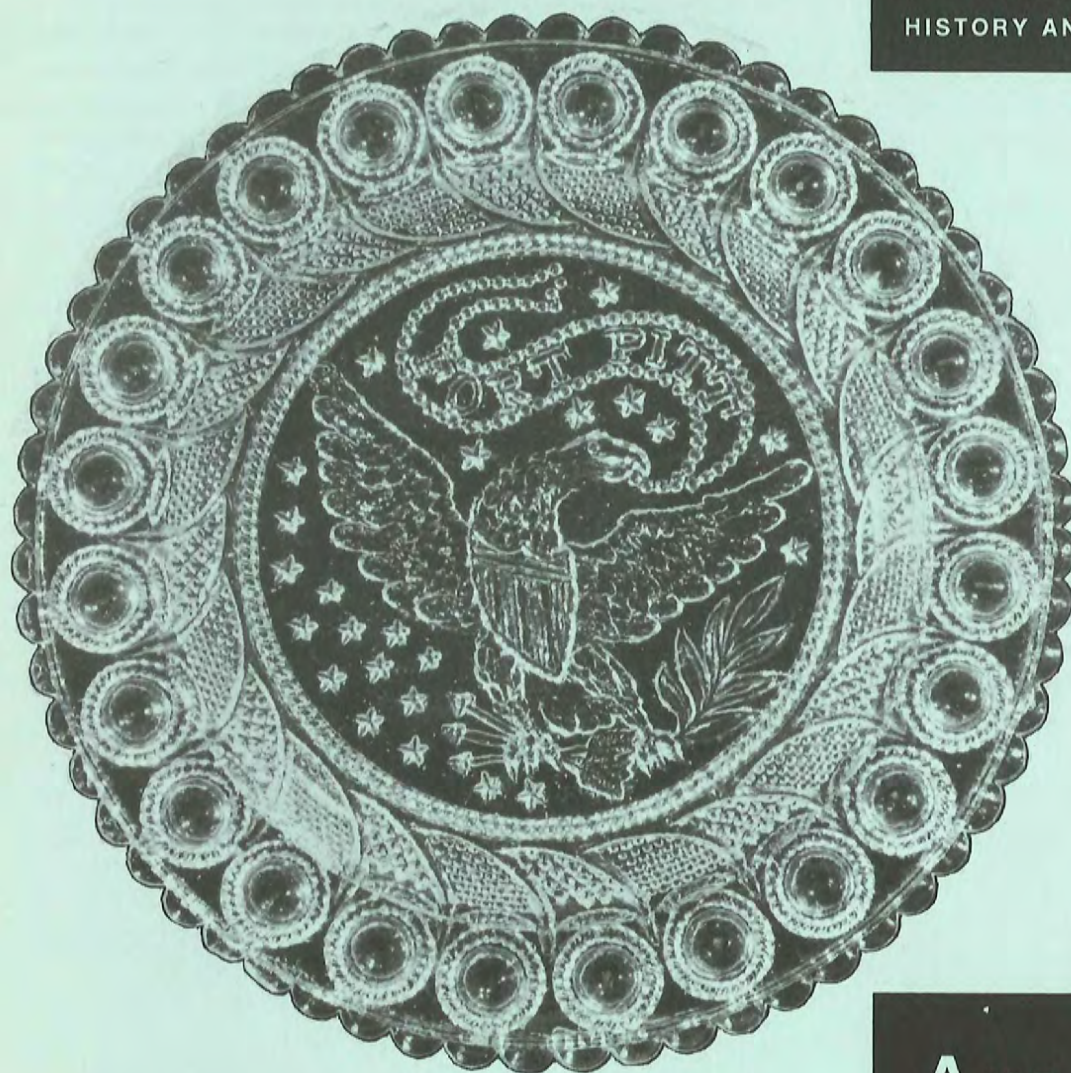


IN
THE
SMITHSONIAN



THE NATIONAL MUSEUM OF
HISTORY AND TECHNOLOGY



American
Glass

PAUL V. GARDNER
CURATOR,
DIVISION OF CERAMICS

A Short History of Glassmaking

Glass is made by melting the mineral silica—usually in the form of sand—with soda, lime, potash, or lead to facilitate fusion and increase brilliance. The glass formulas, or “batches,” vary according to the type of glass desired. Most glass in bottles, window glass, utilitarian and ornamental pieces is called soda-lime glass because the batch is essentially a mixture of sand, soda, and lime. When glass has a high lead content—often a fourth or more of the batch’s weight—a brilliant, resonant glass results which is especially fine for cut and engraved pieces.

Sand often contains impurities such as iron, which gives a greenish tinge to the glass. This greenish color can be neutralized by adding manganese dioxide, called “glassmaker’s soap,” to the batch to produce clear colorless glass. If too much manganese is added, a pinkish shade may develop. Glass containing manganese will also turn pinkish or purplish when exposed to the sun for prolonged periods.

Colored glass is made by adding metallic oxides to the glass batch. Cobalt produces blues; copper, turquoise blue and turquoise green (and sometimes ruby red); gold and selenium produce ruby red or pink; manganese produces amethyst and purple; etc.

The art of glassmaking evolved many centuries ago, probably in Egypt or Mesopotamia. Although the earliest glassware with a known dating was produced about 1500 B.C., glass objects were probably made several centuries before that time. Until about the first century B.C., when glassblowing was discovered in the Roman Empire, glass objects were scarce, luxury items. Some were carved from glass ingots, like objects cut from rock crystal. Others were produced by covering with hot glass a claylike or sandy core—usually attached to an iron rod—by dipping the core into molten glass or by winding hot threads of glass around it. After the vessel cooled, the core was removed.

Most ancient glass, prior to the Roman era, is opaque or translucent. With the advent of glassblowing, clear (transparent) glass became fairly common. Free-blown and mold-blown forms for utilitarian and ornamental purposes were now available for all classes of society (figs. 1-4).

After the fall of the Roman Empire, glassmaking declined in Europe and did not regain prominence there until about the 15th century in the Italian cities of Venice and L’Altare. From these sources, glassmaking knowledge gradually spread throughout Europe. When Europeans settled America, they brought their styles and techniques with them.

Figs. 1-4. These engravings from Diderot's Pictorial Encyclopedia of Trades and Industry show different aspects in the glass-making process: (1) interior of hollow glassware factory; (2) blowing bottle glass; (3) spinning crown or window glass; (4) pressing a base onto a goblet.



1



2



3



4

American Beginnings

Glassware to modern-day Americans usually means ornamental objects and tablewares, but to the early 17th-century settlers of the Virginia colony it meant bottles and windowpanes. Fine tableware was not made for another 150 years. Inventories of colonial homes indicate that early Americans used pewter and ceramic dishes and that quality glassware, even in the 18th century, was an expensive rarity that principally adorned upper-class tables.

The first glass factory was founded in Jamestown, Virginia, in 1608 (fig. 5). Eight glassmakers, Poles and Germans or Dutch, came from Europe for this venture, which ended unsuccessfully about a year later. Captain John Smith of the Virginia colony noted in 1608 that "tryals of glasse" along with other colonial productions were sent to England that year but there is no description of them. The few fragments that survive from this factory site—and from later attempts in Jamestown in 1621 and in Salem, Massachusetts, and New Amsterdam in the 1640s—suggest that bottles were probably made.

In 1739 Caspar Wistar founded the first successful glasshouse in the American colonies in southwestern New Jersey on a site later called Wistarberg. Windowglass and bottles were the staples which kept the factory running as a family business until 1780. After Wistar's factory closed, the South Jersey glassmaking center shifted to Glassboro, where the Stranger brothers' factory, and later the Olive Glass Works and the Harmony Glass Works, continued to make glasswares in the 19th century.

South Jersey continued to be an important glassmaking center after the Revolutionary War period. Often European workmen, who staffed these original factories, would set up their own operations. This partially accounts for the spread of the "South Jersey" tradition, which appeared in varied forms in New England, New York, Ohio, and Pennsylvania in the 18th and 19th centuries. These so-called "South Jersey" pieces were mostly blown off-hand—fashioned on the blowing iron with the aid of glassmaker's tools—or pattern-molded—made from glass which has been dipped in a mold to obtain the pattern and then expanded by the blower (fig. 6). They were usually in greenish colors, shading from aquamarine to deep olive, and in amber hues, although there are a few rare pieces in blues, deep wines, and maroons. These were both useful and ornamental wares, often with applied decorations including threadings, prunts (blobs of glass) in the shape of leaves or strawberries, rigaree (ribbed bands), crimped decorations, and the popular "lily-pad."

Some early writers erroneously attributed these pieces to the Wistar and Stranger factories, and this "South Jersey" designation has continued, although most of these objects are now known to have been made elsewhere. In addition to their rarity, these wares are unrestrained in style, probably because they were made at the whim of the glassmaker without factory supervision.



Fig. 5. No drawings exist of the original Jamestown glasshouse. The glasshouse now operating at Jamestown looks similar to Diderot's engraving of an 18th-century French crown glass factory.



Fig. 6. The South Jersey-type pitcher with lily pad decoration and the candlestick were free blown in green glass.

Front cover: A pressed-glass cup plate made by the Ft. Pitt Glass Works, Pittsburgh, Pennsylvania, between 1830 and 1850.

Stiegel and Amelung: First Fine Tablewares

The appearance of German-born Henry William Stiegel in Lancaster County, Pennsylvania, in 1750, was significant because he was the first to attempt to produce in America fine glass tableware equaling the quality of European imports. Originally an iron manufacturer, Stiegel established a window glass and bottle factory at Elizabeth Furnace, Pennsylvania, in 1763. Moderately successful, he decided to expand his glassmaking and his lifestyle. Two years later, he and his partners completed a second glass furnace in nearby Manheim, a planned town which included a mansion where Stiegel lived affluently as a self-styled Baron. In 1769 he opened yet another glasshouse in Manheim. Named the American Flint Glass Works, it employed 130 craftsmen by 1772. Bankruptcy forced Stiegel to close the factory in 1774, however, and a few months later he was in debtor's prison—a tragic ending of the career of the first American manufacturer to produce fine glass tablewares in clear colorless "flint" and in colors. The term flint glass, originally derived from the use of ground flint pebbles in the glass formula, now generally refers to lead glass.

With the aid of his European craftsmen, Stiegel succeeded so well in duplicating English and continental glass, some with engraved and enamel decorations, that unless the glass object has a documented history, it is nearly impossible to tell whether it was made in Europe or at Stiegel's factory. Most authorities refer to the shallowly engraved flips (beakers), mugs, sugar bowls, and the other glass production as "Stiegel-type" when they resemble Stiegel's wares but have no provenance, or known origin. Reproductions similar to Stiegel's pattern-molded shapes, and in his typical blue and green tones, have been made in Europe and America throughout the 19th and 20th centuries (figs. 7 and 8).



Fig. 7. This clear colorless flip glass with engraved decorations was part of a series of Stiegel reproductions made by the Mt. Washington Glass Company, New Bedford, Massachusetts, about 1824.



Fig. 8. A covered mug and two tumblers, probably of American origin, demonstrate the Stiegel-type engraved glass.



Figs. 9 & 10. Two authenticated Amelung pieces, the Margaret Thomas bowl and the Johnson case bottle, are in the Smithsonian collection.



The New Bremen Glassmanufactory established by John Frederick Amelung near Frederick, Maryland, ranks with Stiegel's American Flint Glass Works as an important 18th-century American glasshouse producing ornamental glass and tablewares. Amelung was also German but, unlike Stiegel, he came to America intending to make glass and had arranged the financing of his factory before leaving his native country. Along with 68 workmen, he arrived in Maryland in August 1784 and purchased 2,100 acres near Frederick for his enterprise. The first window glass and hollow wares were sold early in 1785, and by 1787 he had built a complete factory town with dwellings for 136 "living souls," a large community house, and an elegant mansion for himself.

Despite his auspicious beginnings and the fine quality of his glass, Amelung experienced financial difficulties. Like Stiegel, he had launched too ambitious an undertaking and overestimated the American market for fine glass and the competition from imported English and Irish glass. He ceased operations in 1795.

It is easier to identify Amelung's pieces than Stiegel's because special orders were often engraved with names and dates. His work was also characterized by engraved motifs, such as wreaths and swirls, and applied tooled decorations like pincer handles and bird finials. The factory's productions also included useful objects and tablewares in grayish and greenish transparent nonlead glass (figs. 9 and 10).

Still, it is often difficult to identify positively the pattern-molded and off-hand pieces made for general sale by Amelung, and these are usually classified as "attributed to" or "possibly" Amelung (fig. 11). Such pieces may have been made at the New Bremen Glassmanufactory, but they could also have been produced at the New Geneva, Pennsylvania, factory founded in 1797 by Albert Gallatin, later Secretary of the Treasury. It is thought that some of Amelung's former workmen had sought employment there. Gallatin's factory moved to Greensboro, Pennsylvania, in 1804, where it existed until it burned in 1847. The principal output was window glass and bottles, but off-hand wares were also made (fig. 12).



Fig. 11. The applied pincer handles and bird, or chicken, finial characterize this possibly Amelung sugar bowl in clear greenish-yellow glass.



Fig. 12. The clear greenish candlestick was possibly made in Gallatin's factory.



Fig. 13. Free blown in 1833 by William Hall of the Washington City Glass Works, this clear greenish glass bowl has seeds and bubbles, typical of window and bottle glass.



Fig. 14. Probably made at the Bakewell factory, the clear colorless flint glass decanter and stopper were free blown with cut decoration in strawberry diamond and other motifs.



Fig. 15. Cut and engraved glass tumblers with sulfide portraits of political personalities, such as this one of General Lafayette, were made by Bakewell about 1824, at the time of Lafayette's second tour of America.



Fig. 16. The pitchers and decanter in this blown-three-mold grouping were blown into a full-sized iron mold.

At the end of the 18th century, after the failures of Stiegel and Amelung, no American glass factory was producing fine tablewares and ornamental glass. Only about nine glasshouses were in operation, and these were making the basic window glass and bottles.

But a few years later, glasshouses began to flourish. Among them was one located in the nation's capital on the Potomac River, not far from where the Lincoln Memorial now stands. Founded about 1807, the Washington City Glass Works produced window glass until 1838. As in other factories, workmen made off-hand objects after hours (fig. 13).

By 1825 glassmaking was firmly established as one of America's leading industries. After decades of relying on European workmen and methods, America began to lead the way in technical innovations which made possible cheaper and larger production of glassware.

Part of the reason for the glass industry's successful development lay in America's westward expansion and settlement. The Pittsburgh area, including some of what is now Ohio and West Virginia, became an early 19th-century glassmaking center because of its location near coal for fuel and waterways for shipping finished products. The War of 1812 and the depression of 1819 caused many early factories to fail, but by the 1820s economic conditions improved and glass factories became increasingly profitable. By 1850 there were about 40 glass factories in the Pittsburgh area alone, and more than one-third were producing flint glass.

The Pittsburgh Flint Glass Manufactory, founded in 1807 by Benjamin Bakewell and Edward Ensle, was significant because it was the first "Midwest," or Pittsburgh area, glasshouse to devote a major portion of its production to flint glass. In business until 1882, Bakewell's, as it was commonly called, produced some of the finest American cut and engraved glass of the 19th century and supplied table services for several presidents, including Madison and Jackson (figs. 14 and 15).

Blown-Three-Mold Glass

Another explanation for America's ascendancy in the glass field was the reintroduction in 1815 by American glassmakers of an ancient glass-making technique in which the glass is blown into a mold in the actual size of the object. Mold-blown pieces were made by Roman artisans from the first to the fourth centuries A.D. and by Irish glassmakers in the 18th century. The process was revived by American craftsmen as a way of reducing production costs of decorative wares. The designs ranged from imitations of Anglo-Irish cut-glass tablewares to portraits of prominent persons.

This type of glass, now known as "blown-three-mold," because of the two-, three-, and four-part molds in which the glass was inflated, was probably introduced by Thomas Cains at the South Boston Flint Glass Works, which Cains operated from about 1812 to 1820 (fig. 16).

At least two other famous Massachusetts glass factories produced "blown-three-mold" glass in the early 1800s: the Boston & Sandwich Glass Company and the New England Glass Company, which later moved to Ohio and became the Libbey Glass Works. The production of this type of glass spread rapidly to other factories, and a wide variety

of tablewares in transparent colored and colorless glass were made in considerable quantities from New England to the Midwest from 1815 to the 1860s.

Mechanization of Glassmaking

Perhaps the greatest American contribution to the glass industry was the invention of machine pressing of glass in the first quarter of the 19th century. No development since the discovery of the blowpipe, about the first century B.C., did more to revolutionize glass production. Just as the blowpipe, or blowing iron, made it possible for glassmakers of the Christian era to fabricate a wider variety of useful and ornamental glass objects in less time and with greater facility, so the pressing machinery permitted low-cost mass production of a multitude of glass objects. Although handpressing of decanter stoppers, the feet of goblets, and other tablewares had been used by English, Irish, and continental glassmakers since the late 18th century, there is no evidence that European factories used machine pressing until after it was a well-established production technique in America.

The first American patent for machine pressing of glass was granted to John P. Bakewell of Pittsburgh in 1825 for "an improvement in making glass furniture knobs." Henry Whitney and Enoch Robinson of the New England Glass Company received a patent for improvements in the process in 1826 (figs. 17 and 18). During the late 1820s this company and the Boston & Sandwich Glass Company experimented with the new technique. But the quantity and quality of machine-pressed glass produced by the Boston & Sandwich Glass Company from 1827 to the 1840s gave it a preeminence among the glasshouses of the time, so much so that this type of glass came to be called "Sandwich" glass.

"Lacy" pressed glass—so named because its finely stippled backgrounds gave the effect of lace—was one of the earliest types made by machine pressing. The Boston & Sandwich Glass Company produced this glass in a wide variety of tablewares, ranging from salts and cup plates to large bowls, in clear and opaque glass, colorless and in varied hues, including blues, greens, amethysts, and opalescent (fig. 19). Although lacy pressed glass has become almost synonymous with Sandwich glass, lacy pieces were produced by several other New England factories and in the Midwest (fig. 20).



Fig. 17. The New England Glass Company manufactured this pair of pressed whale oil lamps in milk white glass.



Fig. 18. The pressed salt and cup plate were popular household objects in the 1820s and 1830s.



19



20

Fig. 19. In the Trefoil pattern with a circular medallion, this lacy-pressed glass bowl was made by the Boston & Sandwich Glass Company.

Fig. 20. Another lacy piece, a dark blue covered sugar bowl in Acanthus leaf and eagle-headed shield design, is attributed to the Providence Flint Glass Company.



Fig. 21. By mid-19th century the more simple pressed patterns, such as this Ashburton sugar bowl, were very popular.



Fig. 22. The sugar bowl and cover were pressed in the rare Coin pattern produced in 1892.

About 1840 a trend toward less ornate pressed designs developed. This was probably the result of a need for cheaper glass during the depression of 1837 and the manufacturers' desire to stimulate sales by a marked change from the lacy styles of the previous two decades. The cost of molds, which for the intricate lacy patterns was high, was reduced with the introduction of the simpler patterns (fig. 21).

This pressed pattern glass was received so enthusiastically that the more popular patterns were expanded to include almost complete table services. Thousands of patterns were developed during the last half of the 19th century and volume sales of machine-pressed glassware have continued to the present day.

A rare design was late 19th-century pressed Coin glass, which duplicated replicas of U.S. coins of 1892 in several denominations. This glass was made by the Central Glass Company and probably by Hobbs, Brockunier and Co., both of Wheeling, West Virginia, for a few months in 1892 until prohibited by the government, since replicas of U.S. money are illegal (fig. 22). Since the 1960s a coinlike motif bearing the date 1887 has been produced by the Fostoria Glass Company, Moundsville, West Virginia.

Cut Glass

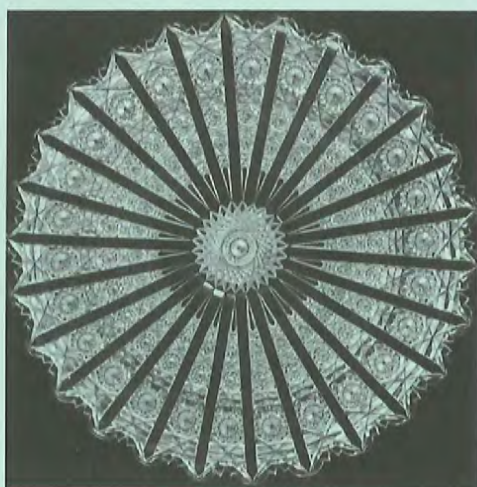
The earliest 19th-century American cut glass was probably made in the Boston area soon after 1812. During the first half of the century, designs similar to Anglo-Irish cut glass predominated, a result of the influence of foreign workmen. From the 1840s through the 1870s plainer designs came into vogue, although traditional patterns continued to be made. With the advent of the "brilliant" period, in the early 1880s, elaborate patterns covering almost the entire surface of the glass were produced in cutting shops on both sides of the Atlantic. An almost endless combination of the basic motifs, such as hob-star, pinwheel, hobnail, block, vesica, fan star, and their variants are found on pieces dating from 1880 to 1925.

Because cut glass was expensive to produce—each piece involved the laborious efforts of skilled craftsmen—it is easy to see why pressed-glass imitations of cut patterns eventually ruined this phase of the glass industry.

During the last quarter of the 19th century, Corning, New York, became a prominent glassmaking center. The Corning Flint Glass Works—later the Corning Glass Works—was established in 1868, forming the nucleus around which a half dozen or more cutting shops and glass factories operated. Probably the best known of these was T. G. Hawkes & Co., which did not make glass itself but bought the "blanks" it decorated from American and European glass factories. In business from 1880 until the 1960s, Hawkes received many awards in national and international exhibitions and produced special cut and engraved glass for heads of state as well as fine pieces for the open market. President Grover Cleveland ordered a service of 600 pieces of Hawkes's Russian pattern in 1885 for the White House, where it was used until the 1930s. The Panel pattern plate, a design patented by Hawkes in 1909, is one of the finest pieces of American cut glass of the "brilliant"



23



24

Figs. 23 & 24. The goblet, cut in Russian pattern, and the plate, in the patented Panel pattern, are examples of Hawkes cut "crystal," or clear colorless lead glass.



25



26

Fig. 25. Mount Vernon was the theme of this engraved goblet made by the Dithridge Flint Glass Co. about 1888.

Fig. 26. Titled the "Apotheosis of Transportation," the clear colorless plate was engraved by the copper wheel process by the Libbey Glass Company.

period and demonstrates the high quality achieved by American factories (figs. 23 and 24).

Many companies making cut glass also used abrasive or copper wheel engravings as decorations either alone or in combination with cut motifs. Engraved designs were left in mat texture—often called "gray" by engravers — or were polished in the style of rock crystal engravings or in combinations of "gray" and polished (figs. 25 and 26).

Art Glass

Paralleling the development of later pressed pattern glass and cut glass in America was the Art Glass movement, fostered by the late Victorian taste for lavish colors and excessively involved designs and surface treatments. Several of the important American glass companies vied with each other and their European competitors to make these exotic creations, which bore equally exotic names.

In Wheeling, West Virginia, about 1885, Hobbs, Brockunier & Company invented Wheeling Peachblow, inspired by the shape and color of Chinese porcelain called Peachblow. This glass—named Coral the first year it was made—was shaded on the outside from ruby red



27



28



29



30

Figs. 27–30. The Art Glass movement is demonstrated by, from top to bottom, Wheeling Peachblow (left), Mt. Washington Peachblow, Burmese, and mother-of-pearl satin glass.

at the top to yellow at the base, and cased or lined with a layer of milk-white glass (fig. 27). It was produced in both bright and mat finishes. Hobbs, Brockunier & Company also manufactured large amounts of bicolored and opalescent wares in Hobnail, Inverted Thumbprint, Swirl, and other patterns. Its Spangled and Spattered glass was very popular, along with pressed Amberina in the Button and Daisy pattern, made under an agreement with the New England Glass Company.

The popularity of Peachblow glass was such that the New England Glass Company patented a version in 1886 under the name "Wild Rose" to avoid legal complications. This glass was quite different in color from Wheeling Peachblow. It shaded from a crushed raspberry at the top to white at the base and had no white lining. It is now commonly called New England Peachblow.

Three years earlier the New England Glass Company had introduced its own art glass, Amberina. This transparent glass shaded from ruby red at the top to orange yellow at the base and has been made in considerable quantities by a number of factories since the late 19th century. Other popular colors made by this factory included an amber-stained Pomona, white-to-deep-rose Agata, and the rare plated Amberina.

The Mt. Washington Glass Company in New Bedford, Massachusetts, also made its variety of Peachblow. It shaded from a bluish-pink top to a light blue-gray base and, like New England's, was without the white lining (fig. 28).

One of the most famous Mt. Washington colors, Burmese, a shade made in the 1880s (fig. 29), was so admired by Queen Victoria that the English firm of Thomas Webb and Sons obtained permission to produce it in England under the name of Queen's Burmese. Mt. Washington also made Amberina, which was finally called Rose Amber to avoid a lawsuit with the New England Glass Company. Crown Milano, Royal Flemish, and Albertine were other much-sought-after art glasses made by Mt. Washington.

Another popular art glass of the 1880s and 1890s was mother-of-pearl satin glass—a satinlike surface texture over an air-trap pattern (fig. 30). It has been abundantly reproduced by Venetian glassmakers in recent years.

One of the greatest American glass factories of the late 19th and early 20th centuries was Tiffany Furnaces, the Corona, Long Island, establishment of Louis Comfort Tiffany. Tiffany's first glassmaking achievements in the 1880s were stained-glass windows for church and residential use. In the next decade he produced a wide variety of colorful ornamental glass as well as lamps and other lighting fixtures combining glass and metal. He is especially known for his Favrite glass—a composition of colored glasses worked together while hot (figs. 31 and 32). Tiffany glass went out of fashion with the demise of Art Nouveau, a highly stylized art form of the early 20th century, and Tiffany Furnaces closed in 1928. In the mid-1950s interest in his glass revived.

Among Tiffany's foremost competitors was Frederick Carder, who founded the Steuben Glass Works in Corning, New York, in 1903. Probably no other single factory produced a greater range of colors and techniques than did Carder's from 1903 to 1932. His Gold and Blue

Aurene—an iridescent glass with metallic designs and swirls—rivalled Tiffany's Favrite. Millefiori, Intarsia (fig. 33), Tyrian, and façon de Venise objects compete with each other for the viewer's admiration. Since 1933 Steuben has produced only crystal glass (fig. 34). These fine, handcrafted pieces include elegant table services, sculptured ornaments, and handsomely engraved special designs made for presidential gifts to heads of state.

In the 1960s a new movement in American glassmaking developed in which the artist and glassmaker are one and the same person who evolves his own glass formulas, melts his own glass, and fabricates pieces to his own designs. Pioneered by Dominick Labino of Grand Rapids, Ohio, and Harvey Littleton of Madison, Wisconsin, and encouraged by the Toledo Museum of Art, studio glassmaking has spread rapidly as an art, not just a craft. About 50 American colleges and universities offer glassmaking courses, and the movement has influenced contemporary glassmaking in several European countries.

Thus glassmaking, which started out in America as a European skill, is now a thoroughly American art and industry in which Americans have pioneered new techniques. Once a rarity, glassware is produced in such abundance that utilitarian objects, such as bottles, are disposable items. And the industry which at first produced only window glass and bottle glass now manufactures ornamental wares, safety glass for automobiles, tempered glass for doors, and fiberglass for fabrics used in boats, electrical printed circuits, and rocket nose cones.

Additional References

McKearin, George S. and Helen. *American Glass*. New York: Crown Publishers, 1948.

Revi, Albert Christian. *Nineteenth-Century Glass, Its Genesis and Development*. New York: T. Nelson, 1959.

Watkins, Lura W. *American Glass and Glassmaking*. London: M. Parrish, 1950.

Produced by Tobia Frankel for the National Museum of History and Technology, Smithsonian Institution. Published by the Smithsonian Institution Press, Washington, D.C. © copyright 1977 by Smithsonian Institution.

Photographs by Smithsonian Institution. All objects illustrated, unless otherwise identified, are in the collection of the National Museum of History and Technology.

A list of other publications in this series can be obtained from the Smithsonian Museum Shops and the Smithsonian Bookstore, the National Museum of History and Technology, Washington, D.C. 20560.



Fig. 31. This tall Tiffany Favrite vase has an iridescent gold surface.



Fig. 32. A Tiffany Favrite covered jar in clear yellowish amber glass was decorated with a feather motif.



Fig. 33. Frederick Carder designed this Intarsia vase in clear colorless and pale amethyst glass.



Fig. 34. Steuben crystal is exemplified by the Gazelle Bowl, designed by Sidney Waugh in the early 1930s.

				
<i>L.C. Tiffany Favre</i>		 <i>Honesdale</i>		<i>Quezal</i>
				
<i>STEUBEN AURENE</i>		 HAWKES		<i>Tuthill</i>
			<i>Libbey</i>	 RG

Outstanding glass objects and the marks of their manufacturers